IOP Conference Series: Materials Science and Engineering 2018 vol.365 N4

Calculation of the stress-strain state of soil massifs with karst-suffusion cavities

Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

© Published under licence by IOP Publishing Ltd. For the North-Eastern part of the Kazan the problem of karst-suffusion danger is rather actual that is associated with the presence and occurrence close to the surface of carbonate eluvium. Currently in this area of the city is an active construction of various facilities. This article is presented the results of calculation the parameters of the cavities and their spatial location on condition of that collapse of the soil massif is possible. The calculation model included the geometrical model of the engineering-geological section, supplemented by physical and mechanical properties as well as a cavity of cylindrical shape of different geometry. Earlier, the authors have completed and published studies to determine the critical diameter and critical depth of a cavity having the form of a simple cylinder. In reality the cavities have a more complex geometry so in this work the modelling was aimed at finding the critical parameters for different types of karst-suffusion cavities discovered in the study area. The simulation results have allowed establishing that the danger of collapse of the soil above the cavity largely depends on its diameter and position in space. Several typical calculation cases were identified. For each case was the effect of the cavity on the redistribution of stresses in the soil massifs. It is possible to develop recommendations for the design of buildings and structures in the study area. The research results showed good agreement with the results of field studies.

http://dx.doi.org/10.1088/1757-899X/365/4/042058

References

[1] Shevelev A I, Zharkova N I, Khuzin I A, Polyakov S I, Galeev R K, Serebrennikova I A, Latypov A I, Nuriyev I S, Ahiyarova Y R and Mukhamedshina M I 2012 Hydrogeological and geotechnical conditions of Kazan city (Kazan: K(VR)FU) 236

[2] Zharkova N, Latypov A, Shevelev A and Khuzin I 2016 Development of a permanent geological environment model of Kazan city aimed to solve various engineering-geological problems (Russia) IOP conference series: Earth and environmental science 33 012048

[3] Latypov A I, Zharkova N I and Mouraviev F A 2013 Dispersed weathering products of carbonate rock: Features and formation conditions from the construction's point of view (by the example of Kazan, Russia) Global View of Engineering Geology and the Environment Beijing China (London, 24-25 September 2013) (Taylor & Francis Group) 891-896

[4] Voznesenskii E A, Latypov A I and Zharkova N I 2016 Seismic Fluidification of Soil in the Bed of the Kazanskaya Riviera Tower Soil Mechanics and Foundation Engineering 53 257-263

[5] Strokova L A, Dutova E M, Ermolaeva A V, Alimova I N and Strelnikova A B 2015 Karst hazard assessment in the design of the main gas pipeline (South Yakutia) IOP Conference Series: Earth and Environmental Science 27 conference 1

[6] Teterin E A and Strokova L A 2015 Methods for karst hazard forecast and pipeline protection in South Yakutia IOP Conference Series: Earth and Environmental Science 27 conference 1 012033

[7] Ter-Martirosyan A Z and Ter-Martirosyan ZG 2015 Interaction between finite stiffness broadened heellong pile and the surrounding soil Procedia Engineering 111 756-762

[8] Ter-Martirosyan Z G and Ter-Martirosyan A Z 2013 Rheological properties of soil subject to shear Soil Mechanics and Foundation Engineering 49 219-226

[9] Ter-Martirosyan Z G, Ter-Martirosyan A Z, Strunin P V and Rubcov O I 2014 Stress-strain state of thick-walled soil cylinder with sand core and grillage view of elastoplastic properties of the soil Procedia Engineering 91 286-291

[10] Latypov A, Zharkova N and Voznesensky E 2017 33rd International Conference on Advances and Trends in Engineering Materials and their Applications (Montreal Canada) Zoning of the Kazan City territory by the stability of foundation soil during dynamic impact 45-51

[11] Latypov A, Zharkova N and Nuriev I 2016 International Conference on Modern Problems of Hydrogeology, Geology Engineering and Hydrogeoecology of Eurasia SPGE 2015 33 (Tomsk: National Research Tomsk Polytechnic University) Landslide hazard assessment in city under construction Innopolis (Russia) 012042

[12] Latypov A, Zharkova N and Ter-Martirosyan A 2017 Using plaxis software for the forecasting of karst-suffusion failures in carbonate eluvium International Multidisciplinary Scientific GeoConference Surveying Geology and Mining Ecology Management, SGEM 17 969-976